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Injury To White Pine Crowns In Northern New England In 1955

Unusual development of white pine terminal shoots--due to some sort of damage--was observed during the summer of 1955 throughout northern New England. In at least one instance it was also observed in pitch pine, and it may have occurred in other species.

The damage took many forms but several features have been widely observed. Only the 1955 growth was injured. Most noticeable was the failure of the terminal-bud cluster to develop in the spring of 1955. Abnormal size of needles and abnormal number of needles per fascicle was common. Many leaders that did develop were distorted. Injury was usually followed by the extension of spur shoots in the area where injury occurred.

Some or all of these symptoms have occurred together in varying combinations, but there seem to be two general forms that occur repeatedly. The first, and most common, was failure of the terminal-bud cluster to develop. Usually the terminal bud and all but one or two of the lateral buds were affected. In some, growth was arrested during the swelling stage; others elongated perhaps 0.1 to 0.2 inch before they died. The injured buds were persistent unless accidentally knocked off; but they were dried out, became dark brown in color, and had a pitch mass at the tip.

Recovery took place through the uninjured lateral buds. The shoots from these buds were occompained by few to many shorter shoots that arose from needle fascicles scattered without order around the node. The shoots from buds generally grew to 9 or 10 inches in length, but those from needle fascicles were only 1 to 5 inches long.

The second type of injury appears to have occurred later in the growing season. The terminal shoots--whether normal or the outgrowth of previous injury--apparently had their growing points killed. A cluster of new shoots arose

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around the growing point. Because of their irregular arrangement and the lack of a terminal bud, all of these new shoots appeared to originate from needle fascicles. They were seldom more than 5 inches long. Frequently the original shoot displayed slight to moderate crook in one or more planes. Typical frost ring was also found in these shoots, but was not found in the first type of injury. Only a few of each type were examined for frost ring.

A symptom usually associated with both types of injury was abnormal number and size of needles. From 2 to as many as 11 needles have been observed (2) in a single fascicle. They were larger and more vigorous than normal needles, and they seemed to occur close to the area of injury and on the shoots arising from dormant buds. However, the needles on the spur shoot extensions were usually short and appeared to lack vigor.

The injury has been observed most commonly on trees 3 to 8 feet high where it is easy to see, and the damage to the terminal shoot has attracted the greatest attention. However, it is also evident on trees up to 30 feet high. It may usually be found on upper lateral branches and sometimes on lower branches as well.

Possible causes.--So far, no completely satisfactory explanation has been advanced (3). Winter feeding by grosbeaks (2) and squirrels has been suggested as a cause. Their feeding was observed to have been heavier than usual, but was not considered extensive enough to cause as much damage as has been observed.

Walker (7) suggests pine spittlebug as a cause. He found the insects on the terminal buds but was not sure they were in feeding position. He found no evidence of bud borers but thought some tissue feeder was probably involved because the pitch mass supplanted tissue in the bud tips. Our observations do not support this theory. Most of the affected buds that we have examined appeared externally to be intact.

P. B. Dwoden reports (Northeastern Forest Experiment Station office report) that damaged twigs from southwestern Maine had been infested with Eucosma gloriola, a moth whose larva bores into white pine shoots, causing 6 or 8 inches of the twig to die. However, he did not think that this insect was responsible for the damage under discussion, nor did he find evidence that any other insects were involved.

Thomson (5) has discussed the development of shoots from spur shoots or needle fascicles and the abnormal development of needles after injury. He regards the condition as a traumatic reversion to a more primitive organization of the pine. Another variation of the same response is the development of asparagus-like shoots such as those occasionally observed in the present case (2). These abnormalities are not

symptomatic of any particular cause of injury.

In at least two instances, similar damage in earlier years has been attributed to frost:

Stone (4) reported an unusual crooking of white, red, jack, Scotch, and ponderosa pine leaders in New York in 1953. The crook was often in more than one plane and was similar to, but generally more severe than, that found in 1955 in white pine. In most cases the leaders maintained apical dominance but if the tip or the entire leader was killed, new shoots developed at the lowest point of death. Frost ring was also found in the injured leaders. Stone thought a mid-June frost caused the injury.

Several variations of damage like that of the first type described above were discussed by Kienholz (1), who found them in the 1930 growth of red pine in New Hampshire. He noted that short shoots, abnormal needles, development of lateral buds that had been dormant at the time of injury, and frost ring in the stem were common. Two frosts occurred in the spring of 1930, which he cited as the causes of injury.

Spring weather.--An examination was made of the 1955 spring weather records (6) of 54 stations in the area of northern New England where white pine commonly occurs. There were no great weather differences among most of these stations. The average temperature for the month of April was 2 to 3° F. higher than normal for the month, but the first half of the month was unusually warm, even though minimum temperatures of 32° or lower were regularly reported for most stations until April 12. For example, the records at East Deering, Massabesic Lake, and Durham, N. H., show an average of 24 days when the maximum temperature was 50° F. or more. Fourteen of them occurred from April 1 to 16. At these stations there were 12 to 16 days with maximum temperatures of 60° or more, and two-thirds of them occurred from April 1 to 16.

From April 12 until April 17, few stations reported freezing or near-freezing temperatures. From April 17 to April 21, 51 of the stations reported a minimum temperature of 32° or lower at least 1 day and usually 2 or 3 days. Near-freezing minimums were recorded throughout the period, but the daily maximums remained relatively high.

The next record of freezing temperatures was on April 30 and May 1. It occurred at 27 stations, most of which were located in New Hampshire and Maine. The last frost was the period May 17 to 20, when 35 stations (most of them in New Hampshire and Vermont) had freezing minimum temperatures for at least 1 day.

Relation of frost to white pine growth period.--The average date for height growth of white pine to begin is between May 1 and May 15 throughout the white pine region, al-

though it may vary from this about 2 weeks from year to year or from northern to southern sections. In 1955 B. Husch (University of New Hampshire, Department of Forestry) observed April 21 as the starting date in Fremont, N. H. The above-normal temperatures during the first half of April may have brought on this early growth.

At any rate, since growth was early, the buds were active and probably were particularly sensitive to frost injusy during the general but normal frost period April 13 to 21. This coincidence of starting growth and frost suggests that the death of buds in the first type of injury described above could have occurred during this period. In some localities the April 30 to May 1 frost also may have killed buds.

The last frost of May 17-20 occurred after terminal growth was well started at Fremont and may have been responsible for damage of the second type where buds were not affected.

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